Amendments as Filed Under PCT Article 34

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110/2, 110/3, 110/4, 110/5, 110/6, 110/7, 110/8

accordance with the present invention is a data transmission method applied when a data processing device transmits data with a first data processing device and a second data processing device, the data processing device being provided between the first data processing device and the second data processing device, the first data processing device transmitting data according to a first communication protocol, and the second data processing device transmitting data according to a second communication protocol, and to achieve the aforementioned object, the method is characterized by comprising (i) a dedicated protocol communication step of transmitting data with the first data processing device according to a communication protocol specialized for the first data processing device, (ii) a common protocol communication step of transmitting data with the second data processing device according to a communication protocol common to data processing devices that are likely connected with the data processing device, (iii) a communication protocol converting step of converting the second communication protocol into the first communication protocol, wherein the communication protocol converting step includes the sub-steps of (a) holding special information of the first data processing device extracted from the first communication protocol and information

that is common among the second communication protocols corresponding to the special information, in a form of a conversion table, and (b) converting common information sent from the second data processing device into special information of the first data processing device, referring to the conversion table.

According to the foregoing arrangement, each data processing device has to be capable of communication only according a dedicated protocol of the first data processing device connected thereto and according to the common protocol. Therefore, as is the case with the foregoing control system, it is possible to decrease the

14. A display device (3b), comprising:

a first data communication port (11) connected with a first control unit (2α) having a predetermined first communication protocol specialized for and dedicated for said first control unit (2α);

a second data communication port (12) for enabling data communication with another display device (3β) connected with a second control unit (2β) having a predetermined second communication protocol specialized for and dedicated for said second control unit (2β);

a data processing section (13) that processes data inputted and outputted via said first and second data communication ports (11) and (12) in accordance with a procedure set beforehand;

a display section (14) that provides a display corresponding to information processed by said data processing section (13); and

an input section (16, 12) for inputting the first communication protocol from outside,

wherein data communication with said another display device (3β) is executed according to a common communication protocol.

15. (amended) A data transmission method, applied when a data processing device (5) transmits data with a

first data processing device (2) and a second data processing device (5, 7), said data processing device being provided between said first data processing device (2) and said second data processing device (5, 7), said first data processing device (2) transmitting data according to a first communication protocol, and said second data processing device (5, 7) transmitting data according to a second communication protocol, said method comprising:

a dedicated protocol communication step of transmitting data with said first data processing device (2) according to a communication protocol specialized for said first data processing device (2);

a common protocol communication step of transmitting data with said second data processing device (5, 7) according to a communication protocol common to second data processing devices (5, 7) that are likely connected with said data processing device (5); and

a communication protocol converting step of converting the second communication protocol into the first communication protocol,

wherein:

said communication protocol converting step includes the sub-steps of:

holding special information of said first data

processing device extracted from the first communication protocol and information that is common among said second communication protocols corresponding to the special information, in a form of a conversion table (18a); and

converting common information sent from said second data processing device (5, 7) into special information of said first data processing device (2), referring to said conversion table (18a).

16. (cancelled)

17. (amended) The data transmission method as set forth in claim 15, wherein:

said communication protocol converting step includes the sub-step of:

holding information (18b) about a data transfer format of transfer information transmitted with said first data processing device (2), and

said converting sub-step includes:

converting command data using common information supplied from said second data processing device (5, 7), into special information corresponding to the command data, by using said conversion table (18a); and

converting the converted special information into transfer information specialized for said first data

processing device (2), by substituting the converted special information for undefined information portions of the data transfer format information (18b).

18. The data transmission method as set forth in claim 17, wherein:

in said common protocol communication step, communication is conducted with a plurality of said second data processing devices (5, 7) via a common communication line (6); and

in said dedicated protocol communication step, communication is conducted with said first data processing device (2) via a dedicated communication line (4).

19. A data transmission method, applied when a data processing device (5) transmits data with a first data processing device (2) and a second data processing device (5, 7), said data processing device being provided between said first data processing device (2) and said second data processing device (5, 7), said first data processing device (2) transmitting data according to a first communication protocol, and said second data processing device (5, 7) transmitting data according to a second communication protocol, said method comprising:

through 2cγ), so that preset data are downloaded from said host device (7g) so as to be installed in said display device.

29. The control system (1h) as set forth in claim 28, wherein:

communication between said control unit (2cα through 2cγ) and said corresponding display devices (3hα through 3hγ) is carried out according to a certain protocol, while communication through a network circuit (6) between said display device (3hα through 3hγ) and said host device (7g) is carried out according to a common protocol determined beforehand.

30. (added) A recording medium storing a program that directs a computer to function as a display device, said computer having a first data communication port (11) connected with a control unit (2) having a predetermined dedicated communication protocol specialized for said control unit (2) itself, a second data communication port (12) connected with a certain data processing device (5, 7), and display means (14), said recording medium storing:

a program that directs said computer to function as:

a data processing section (13) that

processes, through a predetermined procedure, data inputted and outputted through said first and second data communication ports (11, 12); and

a display section (14) that provides a display corresponding to the information processed by said data processing section (13), and,

a program that directs said computer to function as:

first communication means (11) that executes data communication with said control unit (2) according to a dedicated communication protocol, by controlling said first data communication port (11); and

second communication means (12) that executes data communication with said data processing device (5, 7) according to a common communication protocol, by controlling said second data communication port (12).

31. (added) A recording medium storing a program that directs a computer to function as a display device, said computer having a first data communication port (11) connected with a first control unit (2α) having a predetermined first communication protocol specialized

for and dedicated for said first control unit (2α), a second data communication port (12) for enabling data communication with another display device (3β) connected with a second control unit (2β) having a predetermined second communication protocol specialized for and dedicated for said second control unit (2β), and display means (14), said recording medium storing:

a program that directs said computer to function as:

a data processing section (13) that processes, through a predetermined procedure, data inputted and outputted through said first and second data communication ports (11, 12);

a display section (14) that provides a display corresponding to the information processed by said data processing section (13);

an input section (16, 12) that inputs the first communication protocol from outside; and

communication means (12) that executes data communication with said another display device (3β) according to a common communication protocol, by controlling said second data communication port (12).

32. (added) A recording medium storing a program that directs a computer to function as a data processing

device (5) provided between a first data processing device (2) and a second data processing device (5, 7) so as to transmit data with said first and second data processing devices (2, 5, 7), said first data processing device (2) transmitting data according to a first communication protocol, and said second data processing device (5, 7) transmitting data according to a second communication protocol, said recording medium storing:

a program that directs said computer to execute:

a dedicated protocol communication step of transmitting data with said first data processing device (2) according to a communication protocol specialized for said first data processing device (2);

a common protocol communication step of transmitting data with said second data processing device (5, 7) according to a communication protocol common to second data processing devices (5, 7) that are likely connected with said data processing device (5); and

a communication protocol converting step of converting the second communication protocol into the first communication protocol,

and,

as a program for execution of said communication protocol conversion step, a program that directs the said computer to execute the sub-steps of:

holding special information of said first data processing device extracted from the first communication protocol and information that is common among said second communication protocols corresponding to the special information, in a form of a conversion table (18a); and

converting common information sent from said second data processing device (5, 7) into special information of said first data processing device (2), referring to said conversion table (18a).

33. (added) A recording medium storing a program that directs a computer to function as a data processing device (5) provided between a first data processing device (2) and a second data processing device (5, 7) so as to transmit data with said first and second data processing devices (2, 5, 7), said first data processing device (2) transmitting data according to a first communication protocol, and said second data processing device (5, 7) transmitting data according to a second

communication protocol, said recording medium storing a program that directs said computer to execute:

a dedicated protocol communication step of transmitting data with said first data processing device (2) according to a communication protocol specialized for said first data processing device (2);

a data sending step of, prior to said dedicated protocol communication step, selecting a communication protocol from among a group of protocols possessed by itself and sending out preset data according to the selected communication protocol; and

a protocol determining step of waiting for a response from said first data processing device (2), and determining a communication protocol to which a predetermined response is obtained as a communication protocol used for data transmission with said first data processing device (2).

34. (added) A recording medium storing a program that directs a computer to function as a control-use host computer (7) used in a control system (1), said control system (1) including:

a control unit (2) for controlling a control target

(9);

a display device (3) that communicates with said control unit (2) via a dedicated network (4) so as to display or control a control state of said control unit (2) and that, in the case where a common network (6) apart from said dedicated network (4) has a communication protocol different from that of said dedicated network (4), converts one of the protocols into the other protocol; and

said control-use host computer (7) connected with said display device (3) via said common network (6),

said recording medium storing a program that directs said computer to function as an interface section (51) that sends data streams containing instruction contents for said control unit (2) via said common network (6) to said display device (3) connected with said control unit (2).

35. (added) A recording medium storing a program that is applied to a control system (1g) including a control unit (2cα through 2cγ), a host device (7g), and a display device (3gα through 3gγ) so as to direct a first computer to function as said display device (3gα through 3gγ) and a second computer as said host device (7g), said recording medium storing:

a program that controls said first computer to transfer a control output transmitted from said second computer to said control unit (2cα through 2cγ), so as to cause said control unit (2cα through 2cγ) to control a control target (9) in response to a control output transmitted from said host device (7g);

a program that controls said first computer so that the information about control transmitted from said control unit (2cα through 2cγ) should be synthesized and displayed with character and image data installed beforehand; and

a program that controls said second computer so that the character and image data should be installed in said first computer provided between said control unit (2cα through 2cγ) and said host device (7g).

36. (added) A recording medium storing a program that is applied to a control system (1h) including a control unit (2cα through 2cγ), a host device (7g), and a display device (3hα through 3hγ) so as to direct a first computer to function as said display device (3hα through 3hγ) and a second computer as said host device (7g), said recording medium storing:

a program that controls said first computer to transfer a control output transmitted from said second

computer to said control unit (2cα through 2cγ) corresponding to said first computer, so as to cause said control unit (2cα through 2cγ) to control a control target (9) in response to a control output transmitted from said host device (7g);

a program that controls said first computer so that the information about control transmitted from said control unit (2cα through 2cγ) corresponding to said first computer should be displayed; and

a program that controls said second computer so that preset data should be installed in said first computer provided between said control unit (2cα through 2cγ) and said host device (7g).

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and Fig. 19, Fig.22

and being capable of display corresponding to a control state of the control unit, the control system being capable of transmitting data between the control devices, and to achieve the aforementioned object, the control system is characterized in that (i) all the display devices in the control devices are connected with each other via a common communication line, (ii) each display device includes (a) a first data communication port connected with the control unit via the dedicated communication line, (b) a second data communication port connected with another display device via the common communication line, (c) a data processing section that processes data inputted and outputted through the first and second data communication ports, in accordance with a procedure set beforehand, and (d) a display section that provides a display corresponding to information processed by the data processing section, and (iii) data communication between the control unit and the display device is executed according to the dedicated communication protocol specialized for each of the control units individually, while data communication between the display devices is executed according to the common communication protocol.

Incidentally, protocols in a wide sense include protocols (transmission protocols) that have to be

standardized in a network covering a transmitter and a receiver, for, otherwise data per se cannot be transmitted. Such protocols include: codes indicative of a start character, an end character, etc.; transmitting/receiving timings of each character; and methods for identifying the transmitter or the receiver. The protocols also include command systems that have to be standardized between the transmitter and the receiver, for, otherwise, an operation requested by one part and an operation executed by the other part do not coincide, thereby making it impossible to normally execute operations such as control operations. The

regarding a degree of difficulty according to his/her own expertise, by selecting the simple transmission control section or the other transmission control section. Furthermore, the developer of the transmission control section is allowed to recommend which transmission control section should be used, considering expertise of the developer of the host-side display control section. Consequently, it is possible to prevent errors of the control system caused by a mistake of the developer of the host-side display control section.

Furthermore, a control system in accordance with the present invention is a control system in which a control device controls a control target in response to a control output transmitted from a host device, and transmits information about the control to a display device so that the information is synthesized and displayed with character and image data installed beforehand in the display device, and to achieve the aforementioned object, the control system is characterized in that (i) the display device is provided between the host device and a control unit, (ii) the display device includes (a) a first data communication port connected with the control unit, (b) a second data communication port connected with the host device, (c) a data processing section that processes data inputted and outputted through the first

and second data communication ports, in accordance with a procedure set beforehand, and (d) a display section that provides a display corresponding to information processed by the data processing section, (iii) data communication between the control unit and the display device is executed according to the dedicated communication protocol specialized for each of the control units individually, while data communication in a network circuit between the display devices and the host device is executed according to the common communication protocol, and (iv) the character and image data are installed from the host device.

According to the foregoing arrangement, noting that a display device dealing with data of a relatively larger

CLAIMS

1. (amended) A control system (1) including a plurality of control devices (5), each control device (5) including a control unit (2) and a display device (3) connected with said control unit (2) via a dedicated communication line (4) and being capable of display corresponding to a control state of said control unit, said control system (1) being capable of transmitting data between said control devices (5), wherein:

all said display devices (3) in said control devices (5) are connected with each other via a common communication line (6);

each display device (3) includes:

a first data communication port (11) connected with said control unit (2) via said dedicated communication line (4);

a second data communication port (12) connected with another display device (3) via said common communication line;

a data processing section (13) that processes data inputted and outputted through said first and second data communication ports (11, 12), in accordance with a procedure set beforehand; and

a display section (14) that provides a display corresponding to information processed by said data processing section (13);

and

data communication between said control unit (2) and said display device is executed according to said dedicated communication protocol specialized for each of said control units (2) individually, while data communication between said display devices (3) is executed according to said common communication protocol.

2. A control system (1a) as set forth in claim 1, wherein:

a data processing device (7) is connected to said common communication line (6); and

data are transmitted between said data processing device (7) and each display device (3) according to the common protocol.

25. The control-use host computer (7f) as set forth in claim 24, further comprising:

a plurality of transmission control sections (57, 58) that are provided between said interface section (51) and a host-side display section (52a through 52d) for controlling or displaying a state of said control target (9) and that controls said interface section (51) in response to a request from said host-side display section (52a through 52d), so as to transmit or receive data for controlling or displaying the state of said control target (9),

wherein:

one of said transmission control sections (57, 58) is a simple transmission control section (58) that is capable of specifying the request through a simpler procedure than the other transmission control section (57) does.

26. (amended) A control system (1g) in which a control device (5) controls a control target (9) in response to a control output transmitted from a host device (7), and transmits information about the control to a display device (3) so that the information is synthesized and displayed with character and image data installed beforehand in said display device (3),

wherein:

said display device (3gα through 3gγ) is provided between said host device (7g) and a control unit (2cα through 2cγ);

said display device (3gα through 3gγ) includes:

a first data communication port (11) connected with said control unit (2cα through 2cγ);

a second data communication port (12) connected with another display device (3);

a data processing section (13) that processes data inputted and outputted through said first and second data communication ports (11, 12), in accordance with a procedure set beforehand; and

a display section (14) that provides a display corresponding to information processed by said data processing section (13);

data communication between said control unit (2cα through 2cγ) and said display device (3gα through 3gγ) is executed according to said dedicated communication protocol specialized for each of said control units (2cα through 2cγ) individually, while data communication in a network circuit (6) between said display devices (3gα through 3gγ) and said host device (7g) is executed

according to said common communication protocol; and

the character and image data are installed from said host device (7g).

27. (cancelled)

28. A control system (1h) in which a plurality of control units (2) respectively control control targets (9) in response to control outputs transmitted from a host device (7), and information about the controls is displayed in corresponding display devices (3), respectively,

wherein:

said display device (3hα through 3hγ) is provided between said host device (7g) and said control unit (2cα

computer to said control unit (2cα through 2cγ) corresponding to said first computer, so as to cause said control unit (2cα through 2cγ) to control a control target (9) in response to a control output transmitted from said host device (7g);

a program that controls said first computer so that the information about control transmitted from said control unit (2cα through 2cγ) corresponding to said first computer should be displayed; and

a program that controls said second computer so that preset data should be installed in said first computer provided between said control unit (2cα through 2cγ) and said host device (7g).

37. (added) The control system as set forth in claim 1, wherein:

said display device (3) forms a display by providing on one unit screen one or a plurality of processing instruction words (W) each defining a unit data processing operation, and effects the processing instruction word (W) at predetermined intervals, thereby enabling a predetermined display control operation.

FIG. 19

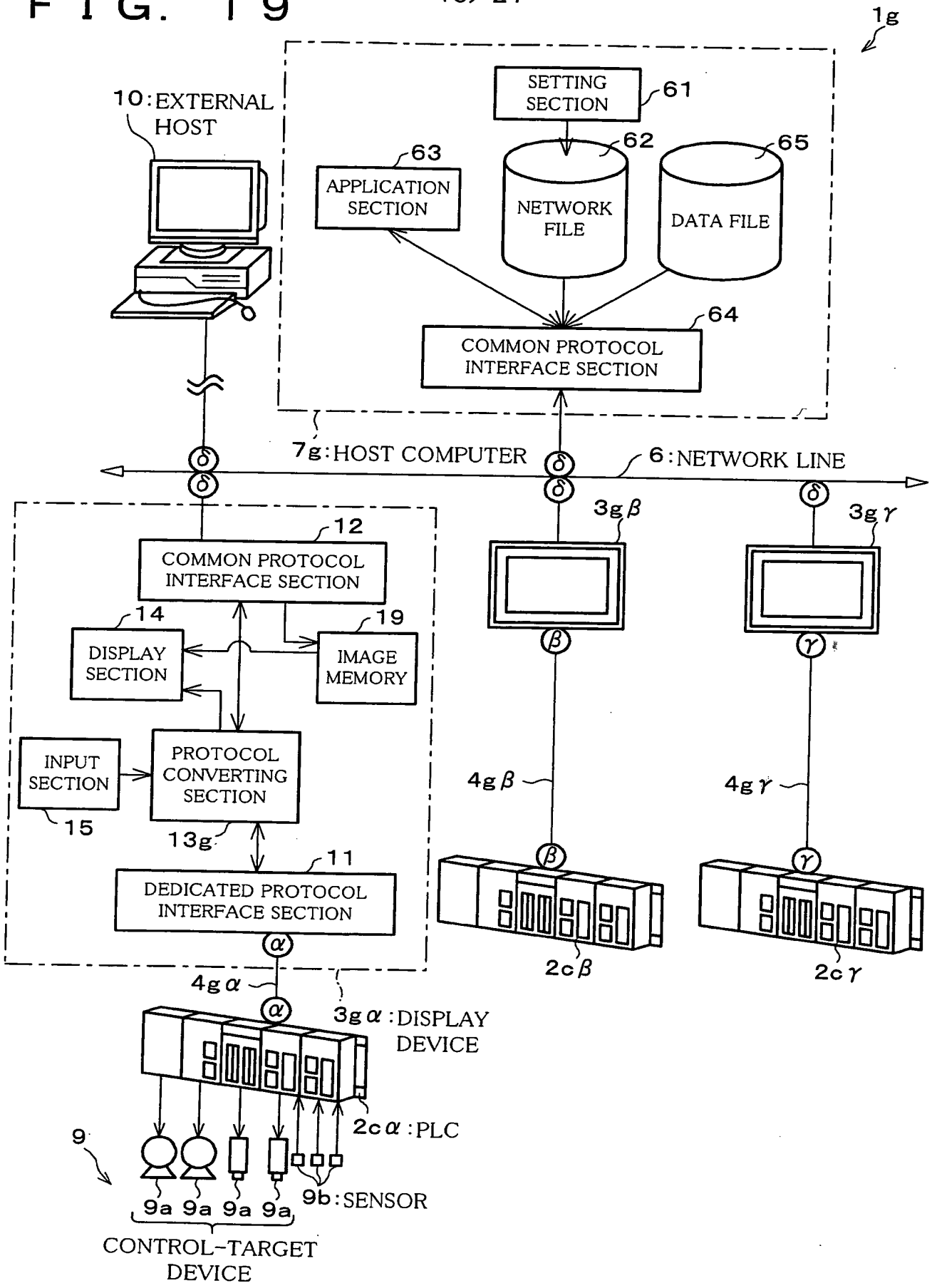

FIG. 22